Rock Chips
Summer 2005

Alberta Geological Survey

EUB/AGS Joins Plains CO_2 Reduction (PCOR) Partnership

In the fall of 2004, the Alberta Energy and Utilities Board (EUB) and Alberta Environment joined the Plains CO_2 Reduction (PCOR) Partnership. The program is one of seven regional partnerships initiated Fall 2003 under the U.S. Department of Energy's Regional Carbon Sequestration Partnership (RCSP) Program to create a network of public-private sector partnerships that would determine the most suitable technologies, regulations and infrastructure needs for carbon capture, storage and sequestration in different areas of the United States.

The PCOR Partnership, which is currently composed of more than 40 private and public sector groups from nine states and the three Canadian Prairie provinces, is assessing the technical and economic feasibility of capturing and storing (sequestering) CO_2 emissions from stationary sources in the northern Great Plains - Prairies and adjacent area (see map below).

The PCOR Partnership region.

The partnership is coordinated by the Energy & Environmental Research Center (EERC) at the University of North Dakota in Grand Forks, North Dakota. Funding is provided by contributions of the partners and the U.S. Department of Energy's National Energy Technology Laboratory Regional Carbon Sequestration Partnership Program. Phase I of the program was structured to be a scoping, assessment and screening effort, lasting two years (2003 to 2005). In Phase II (2006 to 2010), the partnership will progress to the deployment of demonstration projects that will field test and validate promising carbon sequestration technologies as economically feasible and environmentally responsible ways of reducing CO_2 emissions to the atmosphere.

Since the late 1990s, the Alberta Geological Survey (AGS) has been at the leading edge of investigating the potential of geological storage of CO_2 as a means of reducing CO_2 emissions to the atmosphere. AGS has been developing methods and implementing techniques for the evaluation of the suitability and capacity of the Alberta Basin for the large-scale implementation of CO_2 geological storage in oil and gas reservoirs, deep saline aquifers and unmineable coal seams. The Alberta Basin is ideally suited because it is a place where a high number of industrial point sources, at which CO_2 could be captured, coincide with favourable geological conditions, an existing transportation infrastructure (pipelines), the availability of a vast amount of data and information, and knowledge from a century of energy resource exploration and production. To fulfill its role as a world-class regulatory agency, the Alberta Energy and Utilities Board maintains one of the world's most comprehensive collection of data and information related to energy resource development and conservation. Since the late 1980s, the Alberta Basin has been the site of a growing number of acid gas (a mixture of CO_2 and H_2S) injection operations, which can be considered commercial-scale analogues for future CO_2 geological storage in depleted reservoirs and saline aquifers. In addition, a number of pilot projects using CO_2 and acid gas for enhanced oil recovery are underway.

EUB Alberta Energy and Utilities Board
AGS

Under Phase I of the PCOR partnership, AGS is contributing studies on the CO_2 storage capacity in Cretaceous-Tertiary coals in Alberta. Alberta Environment provided funding for part of this activity as their contribution to the partnership. The PCOR partnership has developed a web-based Decision Support System (DSS), which serves as a repository for information on major CO_2 sources and geological sinks and allows partners to browse, query, analyze and download data regarding CO_2 sequestration in the PCOR partnership region through a geographic information system (GIS) mapping interface. In 2004, AGS launched its own web-based, interactive GIS serving information on CO_2 sources and geological sinks in Western Canada (www.ags.gov.ab.ca/gis/) and is providing the partnership access to data and information for Alberta in the appropriate data formats for incorporation into DSS.

Partnership benefits for EUB/AGS include

- timely access to developments and lessons learned at the regional level regarding sequestration and other evolving strategies to reduce CO_2 emissions;
- access to data and information on regional CO_2 sources, sequestration options, regulatory assessments, environmental issue assessments and project modelling;
- regular contact with others in the region who have a stake in developing efficient and environmentally sound options for sequestration;
- access to funding for CO_2 sequestration demonstration projects in Alberta subject to approval under phase II of the U.S. Department of Energy's RCSP Program; and
- cooperation across provincial and international boundaries focused on the solution of technological and regulatory issues related to CO_2 sequestration.

Information on the PCOR partnership can be found at www.eerc.und.nodak.edu/pcor/partnership.asp

For more information on work the Alberta Geological Survey is doing on geological storage of CO_2, please visit our website at www.ags.gov.ab.ca/activities/CO2/CO2_main.shtml. ❖

Rock Chips is published four times a year by the Alberta Geological Survey in the spring, summer, fall and winter.

Past and present issues of *Rock Chips* may be viewed on the AGS website located at www.ags.gov.ab.ca.

To receive the paper version of *Rock Chips*, ask to be placed on our complimentary mailing list. Contact our Edmonton office by

- e-mail: EUB.AGS-Infosales@gov.ab.ca
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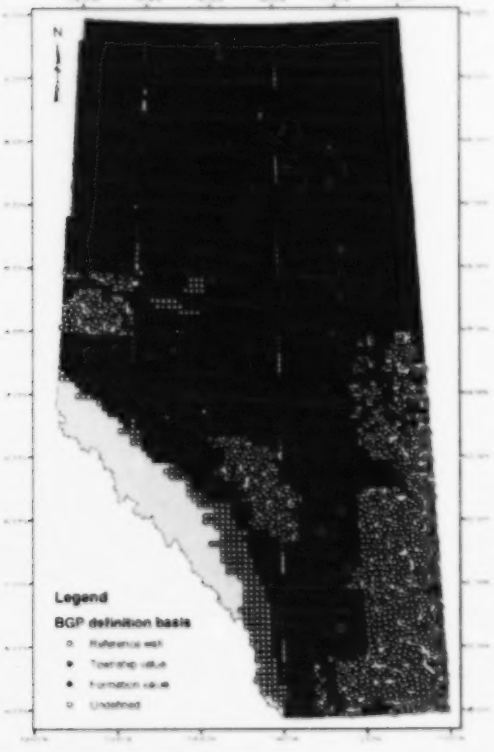
Clients in the Calgary area may view AGS publications at the Alberta Energy and Utilities Board Library, 640 - 5th Avenue SW.
Tel: (780) 297-8242

The Base of Groundwater Protection – Providing Support for Alberta's Energy Industry

Alberta Environment (AENV) and the Alberta Geological Survey (AGS), of the Alberta Energy and Utilities Board (EUB), intend to update and complete the Base of Groundwater Protection (BGP) map of Alberta by March 31, 2007. The BGP is an assigned depth above which groundwater is deemed usable without treatment and thereby entitled to protection under various AENV and EUB guidelines and regulations.

The BGP is defined as the depth in each township at which groundwater salinity exceeds 4 000 mg/L total dissolved solids. Where the aquifer hosting this groundwater is regionally correlatable, the depth of that aquifer's base is identified in a type well as the BGP. The green points on the map below represent locations where the BGP is defined by such type wells. Where there are local difficulties in correlating that aquifer across a township, either a constant depth will be used for the BGP for that township (denoted by the red points on the map), or the base of the host geological formation becomes the BGP (denoted by the blue points on the map). These designations are publicly distributed in the EUB's statistical series document ST-55.



BGP information type coverage.

Additional information on the BGP project can be obtained via the AGS website:

www.ags.gov.ab.ca/activities/Groundwater/base_groundwater_protection.html

Base of Groundwater Protection web page.

Project Tasks

There are three main tasks in this two-year project:

Task 1 - Continue to provide site-specific BGP responses to stakeholders.

Where the base of the host formation is defined as the BGP, or where no information is available in ST-55, a phone-in service has been maintained by AENV to advise industry and the public on the site-specific value of the BGP. As of April 4, 2005, the AGS began responding to these site-specific requests. Site-specific inquiries may be directed to Sheila Stewart at (780) 422-3452 or by e-mail at EUB.AGS-BGP@gov.ab.ca.

Task 2 - Complete the BGP delineation providing complete coverage for all of Alberta.

Since its release in June 1995, ST-55 has not undergone a formal update. The values generated through the site-specific response process have, however, been entered into a spreadsheet. In addition, various AENV initiatives have resulted in updates of the BGP for certain areas of

the province. These datasets will be assembled, analyzed and validated against the existing ST-55 entries. AGS will incorporate information from various water-quality databases maintained by government agencies, as well as information on the extent of geological formations. Our goal is to develop a three-dimensional model of the salinity distribution of subsurface water. This model will allow us to prepare iso-salinity surfaces for the province, valid at the regional scale.

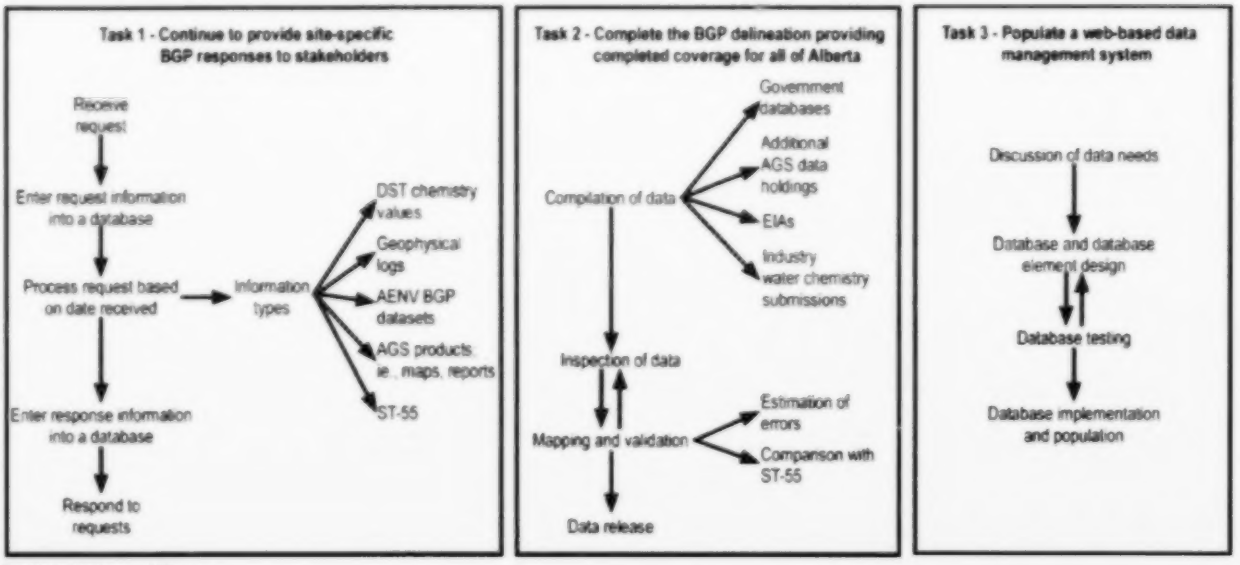
Task 3 - Populate a web-based data management system.

AENV plans to distribute the revised BGP information using a web-based product. At the heart of this product will be a database of BGP values at specific locations. One of the tasks of the AGS will be to provide the database content for this product.

Project task workflows are outlined below.

The current focus of AGS activities is to provide site-specific responses to stakeholders. As this service becomes fully established, much of the focus will turn toward creating the three-dimensional iso-salinity model and comparing previous BGP picks to the newly created surfaces.

Questions on this process may be directed to Tony Lemay at (780) 422-2619 or Tony.Lemay@gov.ab.ca. ❖



Project task workflows.

Story Contact Information

The following AGS staff may be contacted for further information on their articles.

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The Base of Groundwater Protection	Tony Lemay	(780) 422-2619
Surficial Mapping 2005-2006	Roger Paulen	(780) 427-2851
Interactive GIS Map of CBM Potential in Alberta	Dennis Chao	(780) 427-0107
New to the Geology of Alberta Interactive Map.....	Joan Waters	(780) 427-2779

Staff may also be contacted via e-mail by entering the author's first name.last name@gov.ab.ca

Surficial Mapping 2005-2006

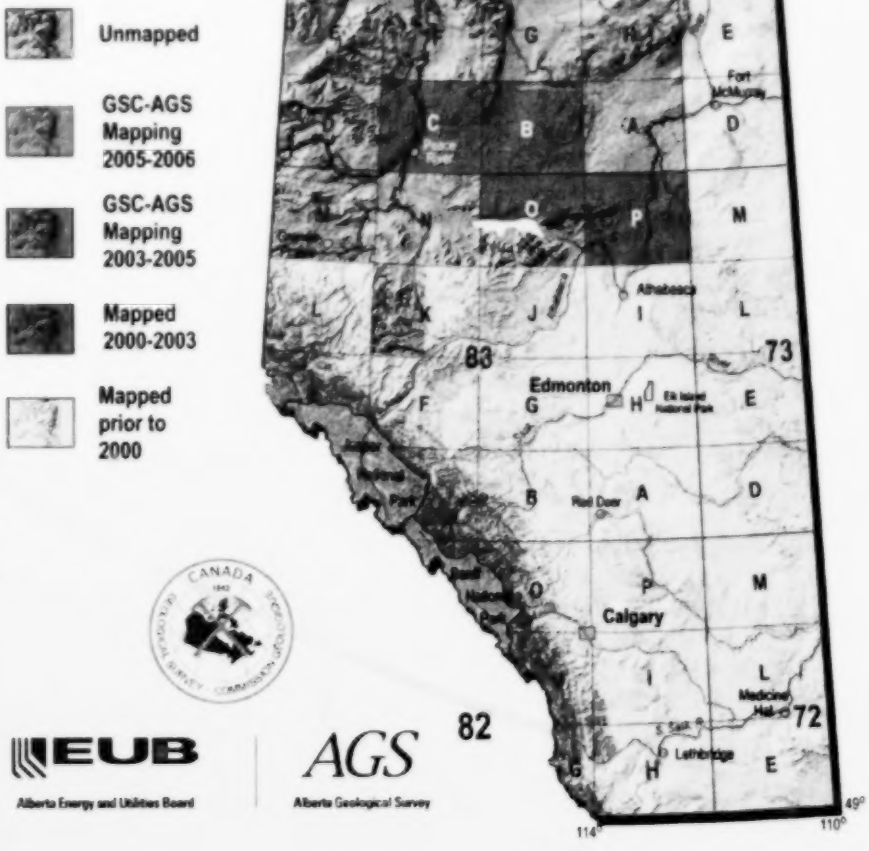
The Alberta Geological Survey enters the sixth year in its long-term, regional surficial mapping program for northern Alberta. This program, started in 2000, supports the mineral exploration and energy industry by providing baseline geological information for northern Alberta with continuous, seamless digital surficial geology map coverage. This year also marks the third year of a collaborative multidisciplinary project with the Geological Survey of Canada (GSC) and the British Columbia Ministry of Energy and Mines. Alain Plouffe (GSC) will participate in completing the surficial mapping for the Mount Watt region.

Maps containing surficial geology information, Quaternary stratigraphy and local surficial sediment properties are important for mineral exploration and development in northern Alberta.

Through this work, AGS will provide basic geological information for mineral exploration and accommodate the increasing demand for infrastructure development (e.g., granular aggregate, landslide potential and permafrost) in northern Alberta. The surficial geology map also provides important information on the various types of surficial materials, ice flow transport directions and delineates regions containing suitable sampling media for drift prospecting surveys.

This year, the project objective is to complete the surficial mapping of the Mount Watt (NTS 84K) map area. This region includes a variety of physiographic terrains, such as the Peace River Valley, Mount Watt, Fort Nelson Lowlands and the Caribou Mountains. This map area also contains several important transportation corridors, linking various conventional energy plays to the west (e.g., Rainbow Lake), agricultural regions to the east, and road and rail links to the Northwest Territories.

High Level is the major population centre in the area. Future editions of Rock Chips will provide information on preliminary scientific discoveries and highlights from the Mount Watt collaborative surficial mapping program. ❖



Surficial mapping status for Alberta.

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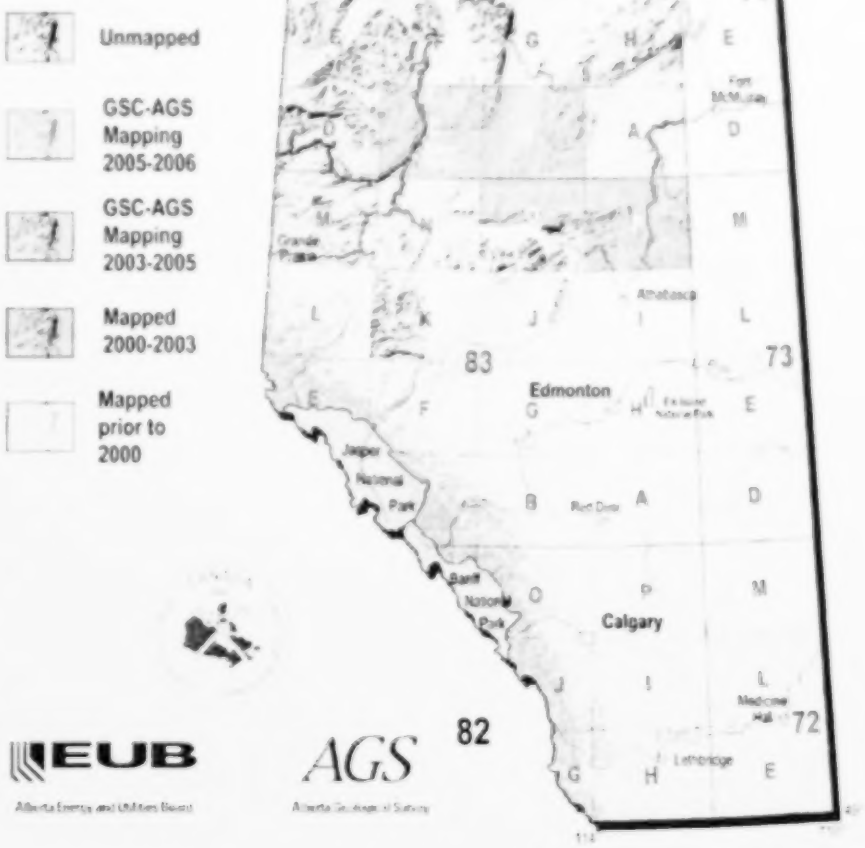


Surficial mapping status for Alberta.

Interactive GIS Map of CBM Potential in Alberta

Alberta has vast amounts of coal, in excess of 2.5 trillion tonnes. Although a small portion of this coal occurs near surface and is suitable for mining, most of these resources lie at great depths below the surface. Methane gas contained within these deeper coal seams may be produced in a manner similar to conventional gas, thereby contributing to Alberta's energy resources. Coalbed methane (CBM) exploration and development is increasing in Alberta. There were 3575 CBM wells drilled to the end of 2004, with 1750 of these on production (EUB Bulletin 2005-15). The Alberta Geological Survey has an extensive coal database and has published several reports documenting coal geology and CBM potential in Alberta. Data and maps of coal occurrence and CBM potential derived from these reports and the database have been produced in an interactive GIS map/data format, and made available on the AGS website for public dissemination at

www.ags.gov.ab.ca/activities/CBM/unconventional_gas_oil_sands.html

Data Display

The CBM Potential GIS website includes the seven main coal zones in the Alberta Plains. Display layers for each coal zone include

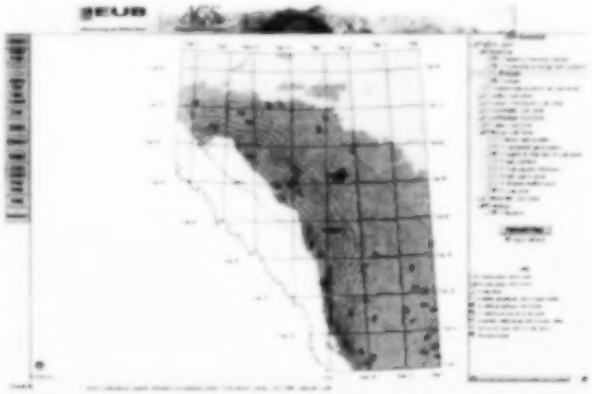
- boreholes intercepting the coal zone and associated coal picks;
- coal zone boundaries;and
- contoured surfaces of calculated gas-in-place, depth to top of coal zone, gas content, coal thickness (isopach), net coal in zone and vitrinite reflectance.

All contoured surfaces and borehole locations are created with data from the Coal Resources/CBM Database (EUB/AGS DIG-001) for the Cretaceous-Tertiary Plains Region of Alberta, published by the Alberta Geological Survey in 2003. Each map layer is displayed by checking its corresponding box in the layer list.

Spatial and Tabular Queries

Each map layer has data attachments as tabular/table attributes. For example, tabular attributes for borehole locations (coal picks) include intercepted coal zone, lithology, well id, well name, ground elevation, KB elevation, well length, top depth and bottom depth. Users can query these attributes by their geographic locations (spatial) or specifying the attribute's criteria (tabular). To perform either query on a map layer, the layer must be activated by clicking the corresponding button in the layer list menu and choosing either the "**Select**" button for spatial query or "**Query**" button for tabular query.

As there are a large number of coal picks in each borehole layer, it is highly recommended to select ten or less borehole locations for each spatial query. The average processing/retrieval time is between 1 to 1½ minutes. The speed of retrieval depends on the number of records matching the search criteria.



Screen capture of CBM GIS interactive map display, showing depth to top of McKay coal zone (www.ags.gov.ab.ca/website/cbm/viewer.htm).

Data Download

Borehole attributes can be downloaded in one of two ways. Users can download borehole attributes returned from queries by using the "**Save attribute to text file**" link in the Query/Selection Results window. Attributes will be saved as a text file in comma separated values format (csv) and can be imported directly to spreadsheet. Alternatively, the entire Coal Resources/CBM Database for the Cretaceous-Tertiary Plains Region of Alberta can be downloaded with the "**Download**" button on the map's toolbar.

Map Printing

A hardcopy map can be produced using the "**Print**" button, or the map can be saved as an image (jpeg, etc.) from the "**Print**" page. When printing a map, users will be asked to enter a map title, select an image resolution and pick one of four printing formats – 8.5" x 11" portrait/landscape or 11" x 17" portrait/landscape. If map feature selections or database queries

are on a map layer, the hardcopy map will include all selected records in a table and the features highlighted on the map.

Further details on the geology and coal zones are described in EUB/AGS Earth Sciences Reports 2002-06 and 2003-03. Information on these reports are at www.ags.gov.ab.ca/publications/. ❖

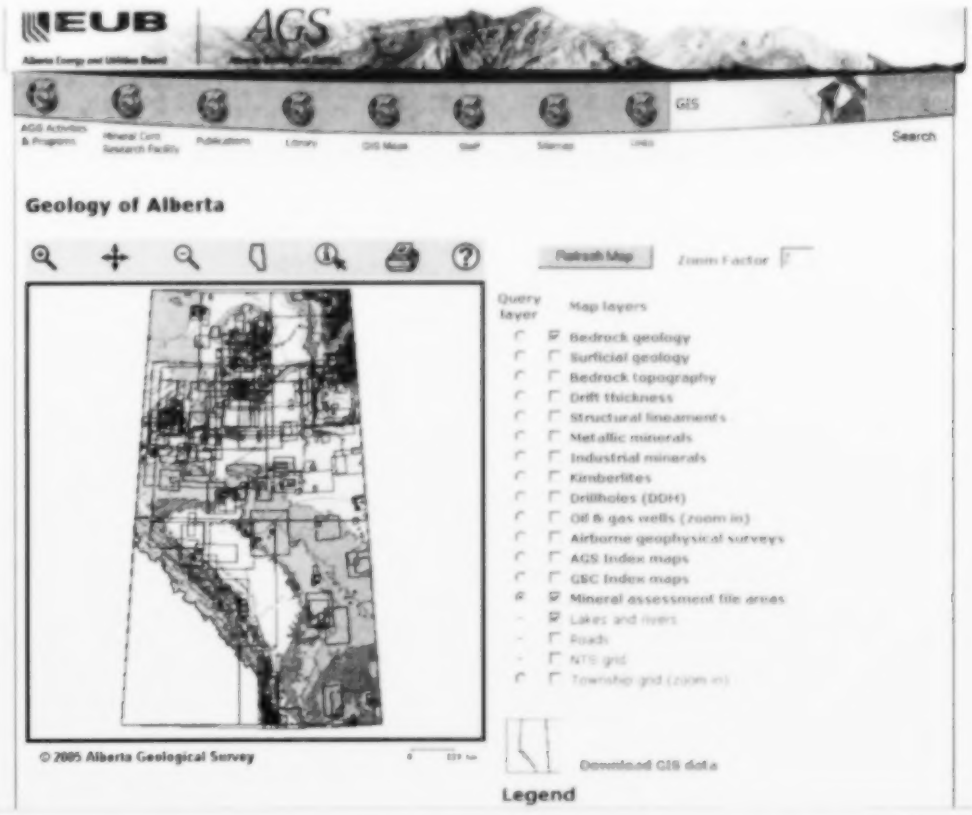
New to the Geology of Alberta Interactive Map – Mineral Assessment Report Areas

The Alberta Geological Survey is the custodian of mineral assessment reports submitted to the Alberta Department of Energy in support of mineral permit work requirements. Now you can view the areas covered by each report (see screen capture below) in our "Geology of Alberta" interactive map (www.ags.gov.ab.ca/GIS/). Click on the Geology of Alberta link, select the Mineral Assessment File Areas box and refresh the map.

When you activate the Mineral Assessment file areas layers, click the query feature icon ( ) and then click your point of interest. A report is generated showing all assessment work on file for that location. Each record in the report contains the mineral assessment report title, exploration purpose/target commodity, permit holder, publication date and a link to more detailed information, including an executive summary. If available, a link to a scanned PDF of the assessment report can be viewed or downloaded at no cost.

This map layer is an up-to-date view of the non-confidential mineral assessment work performed in Alberta, spanning 1949 to late 2004 and comprising 707 submissions. The map layer complements the list of assessment reports available through our Mineral Assessment Reports web page (www.ags.gov.ab.ca/publications).

Future layers will show all AGS map and report locations. ❖



Recently Released Publications

Geo-Notes

GEO 2005-06 Evidence for Kimberlite-Sourced Bentonite in Upper Cretaceous Strata of North-Central Alberta: A Bedrock Characterization Tool to Aid Diamond Exploration. 1.5 MB PDF. $20.00.

GEO 2005-07 Auger Core Lithologs, Sawn Lake Area, Southern Buffalo Head Hills, Alberta. 1.43 MB PDF. $20.00

Earth Sciences Reports

ESR 2005-01 Geochemical Orientation Surveys (Fiscal Year 2000-2001) for Kimberlites in Northern Alberta. 468 MB PDF. $20.00

Mineral Assessment Reports

MIN 20040001 Assessment Report for Alberta Metallic and Industrial Minerals Permits Nos. 9398030064, 9398030065 Clear Hills Area, Alberta. 11 p.

MIN 20040002 Lundbreck Sandstone Project. 11 p.

MIN 20040003 2003 Exploration and Fieldwork Within the Nordegg Metallic and Industrial Minerals Permit West-Central Alberta. 18 p., 2 maps.

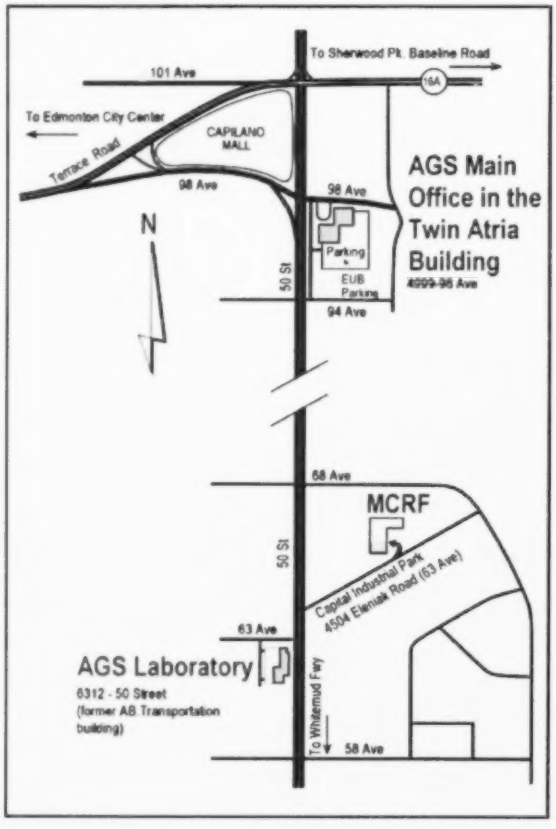
MIN 20040004 Assessment Work Report 2004. 229 p.

MIN 20040006 Shale and Sandstone in the Clearwater Region. 54 p., 1 map.

MIN 20040007 2003 Exploration and Fieldwork at the Corkscrew Mountain Metallic and Industrial Minerals Permit West-Central Alberta. 21 p., 1 map.

MIN 20040008 Assessment Work Metallic and Industrial Mineral Permit No. 9302060002. 71 p., 1 map.

Mineral Assessment Report prices are determined at time of reproduction.



AGS Locations

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The Alberta Geological Survey Library is located at the address above and may be contacted at
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Our Mineral Core Research Facility (MCRF) is located at

4504 Eleniak Road
Edmonton, Alberta

For information on the MCRF or to book a visit, contact Rob Natyshen by phone at (780) 466-1779 or by e-mail at Rob.Natyshen@gov.ab.ca